3E1656

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B. Tech. III Semester (Main/Back) Examination-2014
Computer Engg. & Information Tech.
3CS6A & 3IT6A Advanced Engg. Mathematics-I

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Show $f(x) = 4x^3 - 18x^2 + 27x - 7$ is never optimal in a given interval except at its end points

   b) Find the volume of the greatest parallelopiped that can be inscribed in the ellipsoid.

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

OR

1. a) Minimize $f = 9 - 8x_1 - 6x_2 - 4x_3 + 2x_1^2 + 2x_2^2 + 2x_1x_2 + x_3^2 + 2x_1x_3$

   Subject to $x_1 + x_2 + 2x_3 = 3$

   by constrained variation method.

   b) A rectangular box of height *a* width be *b* is placed adjacent to a wall. Find the length of the shortest ladder that can be made to lean against the wall.

Unit - II

2. a) Solve graphically.

$$\begin{aligned} &Max.\ Z = 6x_1 + 15x_2 \\ &Subject\ to\ 5x_1 + 3x_2 \le 15 \\ &\qquad 2x_1 + 5x_2 \le 10 \\ &\qquad x_1, x_2 \ge 0 \end{aligned}$$

Show that this is an example of infinite solutions.

b) Write the dual of the problem.

$$\begin{aligned} &Max.\ Zp = 2x_1 + 4x_2 \\ &Subject\ to\ 2x_1 + 3x_2 \le 48 \\ &\qquad x_1 + 3x_2 \le 42 \\ &\qquad x_1 + x_2 \le 21 \\ &\qquad x_1, x_2 \ge 0 \end{aligned}$$

OR

2\. a) Solve by simplex method.

$$\begin{aligned} &Min.\ Z = x_1 - 3x_2 + 2x_3 \\ &Subject\ to\ 3x_1 - x_2 + 3x_3 \le 7 \\ &\qquad -2x_1 + 4x_2 \le 12 \\ &\qquad -4x_1 + 3x_2 + 8x_3 \le 10 \\ &\qquad x_1, x_2, x_3 \ge 0 \end{aligned}$$

b) Solve the following assignment problem.

	1	2	3	4
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

Unit - III

3\. a) Define the following:

i) Modulus or absolute value.

ii) Euclidean algorithm.

iii) Rational numbers.

iv) Prime numbers.

b) If there is open statement or a property P_n, involving the number $m \in N$ which is true and whenever it is true for n, prove that it is true for $n+1$ also, giving.

$$1^2+2^2+3^2+4^2+\dots+n^2 = \frac{n(n+1)(2n+1)}{6}$$

OR

3\. a) Prove that every infinite cyclic group has two and only two generators.

b) Show that the set $t(g) = \left\{ \begin{bmatrix} a & 0 \\ b & 0 \end{bmatrix} \middle| a \in z, b \in z \right\}$ is an ideal of the ring

$$R = \left\{ \begin{bmatrix} a & 0 \\ b & c \end{bmatrix} \middle| a, b, c \in z \right\}$$

Matrix addition and matrix multiplication being the operations of the system.

Unit - IV

4\. a) Prove that Laplace transform of the error function is

$$L\left[erf\sqrt{t}\right]=\frac{1}{s\sqrt{1+s}} \text{ if } erf\left(\sqrt{t}\right)=\frac{2}{\sqrt{\pi}}\int_0^t e^{-u^2}dt$$

b) Solve the following equation by Laplace transform

$$\left(D^2+m^2\right)y(t)=a\sin nt \text{ given } y(0)=y'(0)=\infty$$

OR

4\. a) Find the inverse Laplace transform of the following:

$$\frac{1}{S^4}+\frac{a}{S^2+a^2}+\frac{S}{S^2+b^2}+\frac{S-a}{(S-a)^2+b^2}+\frac{S-b}{(S-b)^2+a^2}$$

b) Solve by Laplace transform $\frac{\partial u}{\partial x}-\frac{\partial u}{\partial t}=1-e^{-t}$ in $0<x<l$, under the initial conditions $u(x,0)=x$

Unit - V

5\. a) The ordinate of the normal curve are given by the following table:

x	0.0	0.2	0.4	0.6	0.8
y	0.3989	0.3910	0.3683	0.3332	0.2897

b) Find the value of $\log_e 2$ from

$\int_0^1 \frac{1}{1+x^3}dx$ using Simpson's $\frac{1}{3}$ rule taking four equal intervals.

OR

5\. a) Using Picard's method, obtain the solution of

$$\frac{dy}{dx}=x+x^4y$$

Tabulate: i) $y(0.1)$

ii) $y(0.2)$

b) Use Runga-Kutta forth method to

solve: $\frac{dy}{dx} = -2xy^2, y(0) = 1$ with $h = 0.2$

for i) $x = 0.2$

ii) $x = 0.4$